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A clinico pathological study of thyroid swellings at K.A.P.V Government Medical College;A.G.M.Government hospital, Trichy.

Dissertation submitted for

M.S.General Surgery [Branch-1], March 2010

Certificate

This is to certify that the dissertation entitled “**clinico pathological study of thyroid swellings**” is the bonafide original work of DR.B.ARUNA DEVI in partial fulfillment of the requirements of M.S General Surgery [Branch-1] examination of THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY to be held in March 2010.

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DECLARATION

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The dissertation is submitted to **THE TAMILNADU Dr.M.G.R.Medical University,** towards the partial fulfillment of requirement for the award of M.S Degree (Branch-I) in General Surgery.

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INTRODUCTION

INTRODUCTION

The normal thyroid gland is impalpable. The term goiter (Latin, guttur = the throat) is used to describe generalised enlargement of the thyroid gland. It is a ductless gland.

Biosynthetic defects, iodine deficiency, autoimmune disease, and nodular diseases can each lead to goiter, though by different mechanisms. Graves' disease and Hashimoto's thyroiditis are also associated with goiter. In addition various forms of thyroid cancer are relatively common and amenable to detection by physical examination.

Unique features of thyroid cancer are (1) thyroid nodules are readily palpable, allowing early detection and biopsy by FNA; (2) iodine radioisotopes can be used to diagnose (^{123}I) and treat (^{131}I) differentiated thyroid cancer, reflecting the unique uptake of this anion by the thyroid gland; and (3) serum markers allow the detection of residual or recurrent disease, including the use of Tg levels for PTC and FTC and calcitonin for medullary thyroid cancer (MTC). Differentiated tumors, such as papillary thyroid cancer (PTC) or follicular thyroid cancer (FTC), are often curable, and the prognosis is good for patients identified with early-stage disease.

Because the management of goiter depends on the etiology, the detection of thyroid enlargement on physical examination should prompt further evaluation to identify its cause.

More sensitive methods of detection, such as CT, thyroid ultrasound, and pathologic studies, reveal thyroid nodules in >20% of glands. Most authorities still rely on physical examination to detect thyroid nodules, reserving ultrasound for monitoring nodule size or as an aid in thyroid biopsy.

Otherwise, FNA biopsy should be the first step in the evaluation of a thyroid nodule. FNA has good sensitivity and specificity .The technique is particularly good for detecting PTC. The distinction of benign and malignant follicular lesions is often not possible using cytology alone.

In this study, much emphasis is placed on the clinical presentation of thyroid swellings and the role of pathological investigations in the management of thyroid swellings.

AIM OF THE STUDY

Treatment modalities of thyroid swellings depend on the clinical presentation and pathological evaluation of thyroid swellings.

The aim of the study is to analyze the clinical presentation of thyroid swellings and the role of FNAC in the diagnosis and surgery for thyroid swellings over a period extending from July 2007 to October 2009.

Historical Background

Goiters have been recognized since 2700 B.C. In 1619, Hieronymus Fabricius ab Aquapendente recognized that goiters arose from the thyroid gland. The term thyroid gland (Greek *thyreoeides*, shield-shaped) is, however, attributed to Thomas Wharton in his *Adenographia* (1656). In 1776, the thyroid was classified as a ductless gland by Albrecht von Haller

Roger Frugardi in 1170. In response to failure of medical treatment, two setons were inserted at right angles into the goiter and tightened twice daily until the goiter separated.

The most notable thyroid surgeons were Emil Theodor Kocher (1841–1917) and C. A. Theodor Billroth (1829–1894)

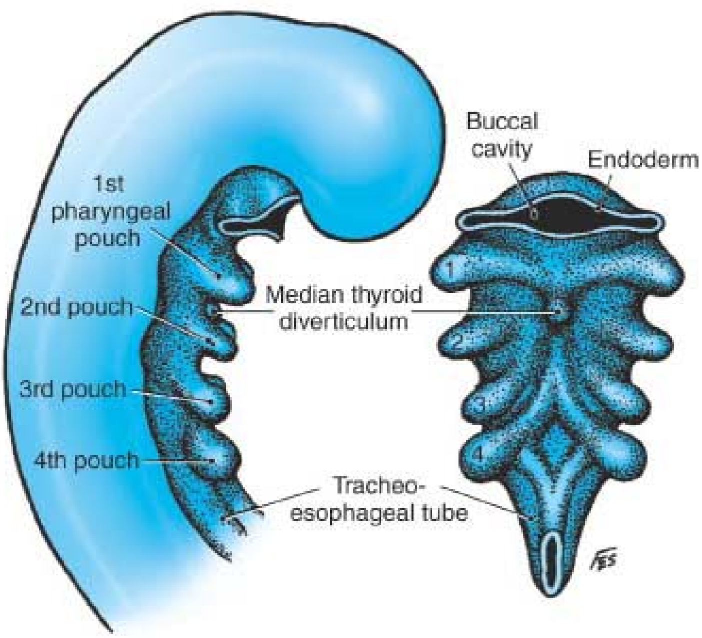
After total thyroidectomy, patients (particularly children) became myxedematous with cretinous features. Kocher used the term "cachexia strumipriva" to describe this condition

Myxedema was first effectively treated in 1891 by George Murray, who used a subcutaneous injection of an extract of sheep's thyroid; later, Edward Fox demonstrated that oral therapy was equally effective.

In 1909, Kocher was awarded the Nobel Prize for medicine in recognition "for his works on the physiology, pathology, and surgery of the thyroid gland."

EMBRYOLOGY

The thyroid gland arises as an out pouching of the primitive foregut around the third week of gestation. It originates at the base of the tongue in the vicinity of the foramen cecum. Endoderm cells in the floor of the pharyngeal anlage thicken to form the medial thyroid anlage that descends in the neck anterior to structures that form the hyoid bone and larynx. It grows downward and backward as a tubular duct, which bifurcates and subsequently subdivides into a series of cellular cords, from which the isthmus and lateral lobes of the thyroid gland are developed. The ultimo-branchial bodies from the fifth pharyngeal pouches are enveloped by the lateral lobes of the thyroid gland; they undergo atrophy and do not form true thyroid tissue. The connection of the diverticulum with the pharynx is termed the thyroglossal duct; its continuity is subsequently interrupted, and it undergoes degeneration, its upper end being represented by the foramen cecum of the tongue, and its lower by the pyramidal lobe of the thyroid gland. The ultimobranchial bodies are neuroectodermal in origin and provide the calcitonin producing parafollicular or C cells, which come to lie in the superoposterior region of the gland. Microscopic thyroid follicles are first apparent as the lateral lobes develop. Thyroid follicles are initially apparent by 8 weeks and colloid formation begins by the 11th week of gestation. In the 3rd month, the follicular cells first demonstrate iodine trapping, and thyroid hormone secretion initially begins.



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Surgical anatomy

General orientations

The adult thyroid gland is brown in color and firm in consistency, and is located posterior to the strap (sternothyroid and sternohyoid) muscles. The thyroid gland is situated in the anterior triangle of the neck, weighs approximately 20 g, and consists of two lateral lobes (right and left), joined together by a midline isthmus. The small pyramidal lobe of Lalouette, of variable size, commonly joins the isthmus at its junction with the left lateral lobe by a fibrous band or strand of muscle fibers known as the levator glandulae thyroideae. The lobes measure approx. 5 × 3 × 1.5 cm (slightly larger in women) and extend from the middle of the thyroid cartilage above to the sixth tracheal ring below. Each lobe fills the space between the trachea and oesophagus medially and the carotid sheath laterally. The lateral or superficial surface is convex, and covered by the skin, the superficial and deep fascia, the Sternocleidomastoideus, the superior belly of the Omohyoideus, the Sternohyoideus and Sternothyreoideus, and beneath the last muscle by the pretracheal layer of the deep fascia, which forms a capsule for the gland. The deep or medial surface is moulded over the underlying structures, viz., the thyroid and cricoid cartilages, the trachea, the Constrictor pharyngis inferior and posterior part of the Cricothyreoideus, the esophagus (particularly on the left side of the neck), the superior and inferior thyroid arteries, and the recurrent nerves. The anterior border is thin, and inclines obliquely from above downward toward the middle line of the neck, while the posterior border is thick and overlaps the common carotid artery, and, as a rule, the parathyroids. The isthmus (isthmus gl. thyreoidea) connects together the lower thirds of the lobes; it measures about 1.25 cm. in breadth, and the same in depth, and usually covers the second and third rings of the trachea. Its situation and size present, however, many variations. In the midline of the neck it is covered by the skin and fascia, and close to the midline, on either side, by the Sternothyreoideus. Across its upper border runs an anastomotic branch uniting the two superior thyroid arteries; at its lower border are the inferior thyroid veins. The thyroid gland is enveloped by a loosely connecting fascia that is formed from the partition of the deep cervical fascia into anterior and posterior divisions. The true capsule of the thyroid is a thin, densely adherent fibrous layer that sends out septa that invaginate into the gland, forming pseudolobules. The thyroid capsule is condensed into the posterior suspensory or Berry's ligament near the cricoid cartilage and upper tracheal rings. The strap muscles (sternohyoid, sternothyroid and superior belly of the omohyoid) are located anteriorly and are innervated by the ansa cervicalis (ansa hypoglossi).

Vascular supply to the thyroid.

The arterial supply to the thyroid gland is supplied by four main arteries, two superior and two inferior. The superior thyroid artery is the first branch of the external carotid artery and separates from that structure immediately above the bifurcation of the common carotid artery. The superior thyroid artery then drops medially onto the surface of the inferior pharyngeal constrictor muscle and enters the substance of the superior pole of the thyroid at its apex. The superior thyroid artery courses medially with the external branch of the superior laryngeal nerve, and this structure must be separated from it when gaining control of the artery. At the apex of the lateral lobe, it divides into a large anterior branch and a usually smaller, but important, posterior branch. Occasionally a tributary leaves high on the left to supply the pyramidal lobe near the midline.

The inferior thyroid artery takes its origin from the thyrocervical trunk. This artery ascends into the neck on either side behind the carotid sheath and then arches medially and enters the thyroid gland posteriorly. There is no direct arterial supply to the thyroid at the inferior boundaries because most of these vascular structures are venous. An occasional inferior arterial supply may occur from a thyroidea ima artery that occurs in the absence of a well-defined inferior arterial supply. The thyroidea ima arteries occur in less than 5% of patients and usually arise directly from the innominate artery or from the aorta.

The inferior thyroid artery has important anatomic relationships. The recurrent laryngeal nerve is usually directly adjacent (in either an anterior or posterior position) to the inferior thyroid artery within 1 cm of its entrance into the larynx. Careful dissection of the artery in this case is mandatory and cannot be completed until knowledge of the position of the recurrent laryngeal nerve is gained. Additionally, the inferior thyroid artery almost always supplies both the superior and inferior parathyroid glands, and care must be taken in evaluating the parathyroids after inferior thyroid artery division.

Numerous unnamed accessory arteries arise from the oesophagus and trachea, but the most frequently encountered is the thyroidea ima (Neubauer's artery), which courses up anteriorly on the trachea to reach the isthmus or one of the lower poles and originates from the aorta or brachiocephalic artery. In the absence of the inferior thyroid artery on one side, the thyroidea ima may be the principal source of blood supply to the lobe and therefore substantial.

Three pairs of venous systems drain the thyroid. Superior venous drainage is immediately adjacent to the superior arteries and joins the internal jugular vein at the level of the carotid bifurcation. The middle thyroid veins exist in more than half of patients and course immediately laterally into the internal jugular vein. The inferior thyroid veins are usually two or three in number and descend directly from the lower pole of the gland into the innominate and brachiocephalic veins. These veins often descend into the tail of the thymus gland.

Lymphatic drainage

The relationship of the thyroid gland to its lymphatic drainage is most important when considering surgical treatment of thyroid carcinoma. The thyroid gland and its neighboring structures have a rich lymphatic supply that drains the thyroid in almost every direction. Within the gland, lymphatic channels occur immediately beneath the capsule and communicate between lobes through the isthmus. This drainage connects to structures immediately adjacent to the thyroid with numerous lymphatic channels into the regional lymph nodes. They drain primarily into mediastinal nodes inferiorly, tracheo-oesophageal nodes laterally, and the midline delphian nodes superiorly. Studies following injection of dye suggest that the majority of lymph from the thyroid returns to the thoracic duct without passing through the deep cervical lymph-node chain or the nodes of the posterior triangle, although these pathways may open up secondarily. This has implications for the assessment of patients with carcinoma of the thyroid, who may develop lymph-node deposits outside the primary drainage areas, even on the contralateral side.

Important anatomical relations

Recurrent Laryngeal Nerve

The recurrent laryngeal nerves ascend on either side of the trachea, and each lies just lateral to the ligament of Berry as it begins to enter the larynx. There are a number of important variations. In about 25% of patients, the recurrent laryngeal nerve is contained within the ligament as it enters the larynx. On the right side, the recurrent laryngeal nerve separates from the vagus as it crosses the subclavian artery, passing posteriorly and ascending in a lateral position to the trachea along the tracheo-esophageal groove. The right recurrent laryngeal nerve can usually be found no further away than 1 cm lateral to or within the tracheo-esophageal groove at the level of the lower border of the thyroid. As it ascends to the midportion of the thyroid, however, the nerve assumes its position within the tracheo-esophageal groove. At this location, the nerve might divide into one, two, or more branches as it enters into the first or second ring of the trachea, with the most important branch disappearing beneath the inferior border of the cricothyroid muscle. The nerve can usually be found immediately anterior or posterior to a main arterial trunk of the inferior thyroid artery at this level. Unusually, a nonrecurrent right laryngeal nerve can arise directly from the vagus and course directly medially into the larynx. This nonrecurrent anatomy is found in 0.5 to 1.5% of patients. Even more infrequently, patients may have both a recurrent and a nonrecurrent laryngeal nerve on the right. These two nerves usually join in a position beneath the lower border of the thyroid.

On the left side, the recurrent laryngeal nerve separates from the vagus as that nerve traverses over the arch of the aorta. The left recurrent laryngeal nerve then passes inferiorly and medially to the aorta and begins to ascend toward the larynx, finding its way into the tracheo-esophageal groove by the time it ascends to the level of the lower lobe of the thyroid. Both recurrent laryngeal nerves, by the time that they are within 2.5 cm of their entrance into the larynx, are consistently found within the tracheo-esophageal groove. These nerves pass either inferiorly or posteriorly to an arterial branch of the inferior thyroid artery and eventually enter the larynx at the level of the cricothyroid articulation on the caudal border of the cricothyroid muscle. Here the nerve is immediately adjacent to the superior parathyroid, the inferior thyroid artery, and the most posterior aspect of the thyroid. Great care is needed in surgical dissection in this area because the nerve is essentially tethered as it dives beneath the cricothyroid muscle and can be placed on stretch by over vigorous dissection .The motor function of the recurrent laryngeal nerve is abduction of the vocal cords from the midline. Damage to a recurrent laryngeal nerve results in paralysis of the vocal cord on the side affected. Such damage might result in a cord that remains in a medial position or just lateral to the midline. A normal voice, albeit weakened, can occur if the remaining functioning contralateral cord is able to approximate the paralyzed cord. If the vocal cord remains paralyzed in an abducted position and closure cannot occur, a severely impaired voice and ineffective cough can be the result. If recurrent laryngeal nerves are damaged bilaterally, complete loss of voice or airway obstruction requiring emergency intubation and tracheostomy may be necessary. Occasionally, bilateral damage can result in cords taking an abducted position, which, although allowing airway movement, may result in upper respiratory infection due to ineffective cough.

Superior Laryngeal Nerve

The superior laryngeal nerve separates from the vagus nerve at the base of the skull and descends toward the superior pole of the thyroid along the internal carotid artery. At the level of the hyoid cornu, it divides into two branches. The larger internal branch has sensory function and enters the thyrohyoid membrane, where it innervates the larynx. The smaller external branch continues to travel along the lateral surface of the inferior pharyngeal constrictor muscle and usually descends anteriorly and medially along with the superior thyroid artery. Within 1 cm of the superior thyroid artery's entrance into the thyroid capsule, the nerve usually takes a medial course and enters into the cricothyroid muscle. This is an extremely important relation because, during the performance of a thyroid lobectomy, the external branch is not usually visualized because it has already entered the inferior pharyngeal muscle fascia. This nerve is at risk of being severed or entrapped, however, if superior pole vessels are ligated at too great a distance above the superior pole of the thyroid. Damage to the external branch can result in a severe loss in quality of voice or voice strength. Although this may not be as clinically devastating as recurrent laryngeal nerve damage, it is extremely bothersome to patients whose occupation demands good voice quality.

The cervical sympathetic chain

This underlies the carotid sheath just medial to the vagus on the prevertebral fascia and is in close proximity to the inferior thyroid artery as it arches around medially.

Parathyroid glands

There are normally four parathyroid glands, the upper pair of which lies in close proximity to the dorsal aspect of the thyroid. They are usually found just above and medial to where the recurrent laryngeal nerve crosses the inferior thyroid artery, frequently tucked round behind its branches. The lower parathyroid gland on each side is situated within a 2-cm radius of the lower pole of the thyroid, typically on its surface anterolaterally and at a level below and medial to where the recurrent laryngeal nerve crosses the inferior thyroid artery.

Thyroid Histology

Microscopically, the thyroid is divided into lobules that contain 20 to 40 follicles. There are roughly 3 x 10^6 follicles in the adult male thyroid gland. The follicles are spherical and average 30 micromm in diameter. Each follicle is lined by cuboidal epithelial cells and contains a central store of colloid secreted from the epithelial cells under the influence of the pituitary hormone, TSH. The second group of thyroid secretory cells is the C cells or parafollicular cells, which contain and secrete the hormone calcitonin. They are found as individual cells or clumped in small groups in the interfollicular stroma and located in the upper poles of the thyroid lobes.

Thyroid Physiology

Iodine Metabolism

The average daily iodine requirement is 0.1 mg, which can be derived from foods such as fish, milk, and eggs, or as additives in bread or salt. In the stomach and jejunum, iodine is rapidly converted to iodide and absorbed into the bloodstream, from where it is distributed uniformly throughout the extracellular space. Iodide is actively transported into the thyroid follicular cells by an ATP-dependent process. In fact, the thyroid is the storage site of greater than 90% of the body's iodine content and accounts for one-third of the plasma iodine loss. The remaining plasma iodine is cleared via renal excretion.

The hormones tri-iodothyronine (T3) and thyroxine (T4) (extracted by E.G. Kendall in 1916) are bound to thyroglobulin within the colloid. Synthesis within the thyroglobulin complex is controlled by several enzymes, in distinct steps:

•trapping of inorganic iodide from the blood;

•oxidation of iodide to iodine;

•binding of iodine with tyrosine to form iodotyrosines;

•coupling of mono-iodotyrosines and di-iodotyrosines to form 13 and T4

•when hormones are required the complex is resorbed into the cell and thyroglobulin broken down; T3 and T4 are liberated and enter the blood.

Thyroid Hormone Synthesis, Secretion, and Transport

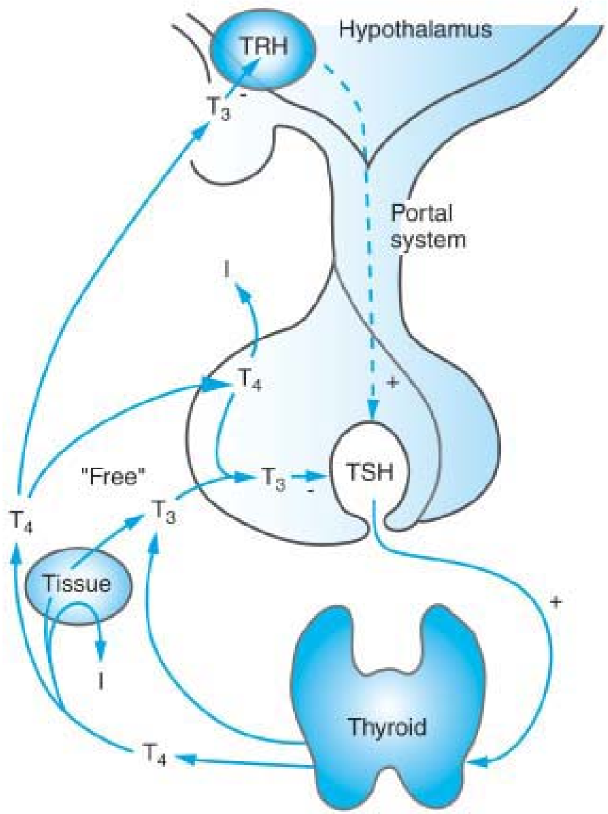
The synthesis of thyroid hormone consists of several steps. The first step, iodide trapping, involves active (ATP-dependent) transport of iodide across the basement membrane of the thyrocyte via an intrinsic membrane protein, the Na^{+}/I^{-} symporter (NIS). Thyroglobulin (Tg) is a large (660-kDa) glycoprotein, which is present in thyroid follicles and has four tyrosyl residues. The second step in thyroid hormone synthesis involves oxidation of iodide to iodine and iodination of tyrosine residues on Tg, to form monoiodotyrosines (MITs) and diiodotyrosines (DITs). Both processes are catalyzed by thyroid peroxidase. The recently identified protein pendrin is thought to mediate iodine efflux at the apical membrane.5 The third step leads to coupling of two DIT molecules to form tetraiodothyronine or thyroxine (T_4), and one DIT molecule with one MIT molecule to form 3,5,3'-triiodothyronine (T_3)

or reverse 3,3',5'-triiodothyronine (rT_3). When stimulated by TSH, thyrocytes form pseudopodia, that encircle portions of cell membrane containing thyroglobulin, which, in turn, fuse with enzyme-containing lysosomes. In the fourth step, thyroglobulin is hydrolyzed to release free iodothyronines (T_3 and T_4) and mono- and diiodotyrosines. The latter are deiodinated in the fifth step to yield iodide, which is reused in the thyrocyte.

In the euthyroid state, T_4 is produced and released entirely by the thyroid gland, whereas only 20% of the total T_3 is produced by the thyroid. Most of the T_3 is produced by peripheral deiodination (removal of 5'-iodine from the outer ring) of T_4 in the liver, muscles, kidney, and anterior pituitary, a reaction that is catalyzed by 5'-monodeiodinase. Some T_4 is converted to rT_3, the metabolically inactive compound, by deiodination of the inner ring of T_4. In conditions such as Graves' disease, toxic multinodular goiter, or a stimulated thyroid gland, the proportion of T_3 released from the thyroid may be dramatically elevated. Thyroid hormones are transported in serum bound to carrier proteins such as thyroxine-binding globulin (TBG), thyroxine-binding prealbumin (TBPA), and albumin. Only a small fraction (0.02%) of thyroid hormone (T_3 and T_4) is free (unbound) and is the physiologically active component.

T_3 is the more potent of the two thyroid hormones, although its circulating plasma level is much lower than that of T_4. T_3 is less-tightly bound to protein in the plasma than is T_4, and so it enters tissues more readily. T_3 is three to four times more active than T_4 per unit weight, with a half-life of about 1 day, compared to approximately 7 days for T_4.

The secretion of thyroid hormone is controlled by the hypothalamic–pituitary–thyroid axis. The hypothalamus produces a peptide, the thyrotropin-releasing hormone (TRH), which stimulates the pituitary to release TSH or thyrotropin. TRH reaches the pituitary via the portovenous circulation. TSH, a 28-kDa glycopeptide, mediates iodide trapping, secretion, and release of thyroid hormones, in addition to increasing the cellularity and vascularity of the thyroid gland. The TSH receptor belongs to a family of G-protein-coupled receptors that have seven transmembrane-spanning domains and utilize cAMP in the signal-transduction pathway. TSH secretion by the anterior pituitary also is regulated via a negative feedback loop by T_4 and T_3. Because the pituitary has the ability to convert T_4 to T_3, the latter is thought to be more important in this feedback control. T_3 also inhibits the release of TRH.



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Calcitonin

Calcitonin is a 32-amino acid polypeptide and is secreted by the C cells, which are parafollicular cells located superolaterally in each thyroid lobe. Calcitonin acts principally to inhibit bone resorption of calcium and thereby to lower peripheral serum calcium levels. Increased peripheral levels of serum calcium stimulate calcitonin secretion. Calcitonin secretion can be stimulated clinically by infusion of calcium, pentagastrin, and alcohol.

The specific action of calcitonin is on the surface receptors of osteoclasts. Calcitonin receptors have also been found in renal tubular epithelium and in lymphocytes. Calcitonin has a direct action on osteoclasts, which may or may not result in a marked decrease in calcium levels. In fact, patients with clinical calcitonin excess syndromes, such as medullary carcinoma of the thyroid (MCT), have little alteration in peripheral calcium metabolism. Basal or stimulated calcitonin levels are sensitive markers for primary or recurrent MCT. Whether calcitonin should be evaluated routinely for all thyroid masses in an attempt to discover the unusual sporadic medullary carcinoma is not universally agreed on.

Thyroid Hormone Function

Free thyroid hormone enters the cell membrane by diffusion or by specific carriers and is carried to the nuclear membrane by binding to specific proteins. T_4 is deiodinated to T_3 and enters the nucleus via active transport, where it binds to the thyroid hormone receptor. The T_3 receptor is similar to the nuclear receptors for glucocorticoids, mineralocorticoids, estrogens, vitamin D, and retinoic acid. In humans, two types of T_3 receptor genes are located on chromosomes 3 and 17. Each gene product has a ligand-independent, aminoterminal domain; a ligand-binding, carboxyterminal domain; and centrally located DNA-binding regions. Binding of thyroid hormone leads to the transcription and translation of hormone-responsive specific genes.

Thyroid hormones affect almost every system in the body. They are important for fetal brain development and skeletal maturation. T_3 increases oxygen consumption, basal metabolic rate and heat production by stimulation of Na^+/K^+ ATPase in various tissues. It also has a positive inotropic and chronotropic effect on the heart by increasing transcription of the Ca^{2+} ATPase in the sarcoplasmic reticulum and increasing levels of beta-adrenergic receptors and concentration of G proteins. Myocardial receptors are decreased and actions of catecholamines are amplified. Thyroid hormones are responsible for maintaining the normal hypoxic and hypercapnic drive in the respiratory center of the brain. They also increase gastrointestinal motility, leading to diarrhea in hyperthyroidism and constipation in hypothyroidism. Thyroid hormones also increase bone and protein turnover and the speed of muscle contraction and relaxation. They also increase glycogenolysis, hepatic gluconeogenesis, intestinal glucose absorption, and cholesterol synthesis and degradation.

Pathology

The normal thyroid gland is impalpable. The term goiter (Latin, guttur = the throat) is used to describe generalised enlargement of the thyroid gland. A discrete swelling (nodule) in one lobe with no palpable abnormality elsewhere is termed an isolated (or solitary) swelling. Discrete swellings with evidence of abnormality elsewhere in the gland are termed dominant.

Classification

- ❖ Simple
- ❖ Toxic
- ❖ Neoplastic
- ❖ Inflammatory
- ❖ Infective
- ❖ Others

Simple goiter

Aetiology

Simple goiter may develop as a result of stimulation of the thyroid gland by TSH, either as a result of inappropriate secretion from a micro adenoma in the anterior pituitary (which is rare), or in response to a chronically low level of circulating thyroid hormones. The most important factor in endemic goiter is dietary deficiency of iodine but defective hormone synthesis probably accounts for many sporadic goiters. TSH is not the only stimulus to thyroid follicular cell proliferation and other growth factors including immunoglobulins exert an influence. The heterogeneous structural and functional response in the thyroid resulting in characteristic nodularity may be due to the presence of clones of cells particularly sensitive to growth stimulation.

Stages in goiter formation are:

•Persistent growth stimulation causes diffuse hyperplasia; all lobules are composed of active follicles and iodine uptake is uniform. This is a diffuse hyperplastic goiter, which may persist for a long time but is reversible if stimulation ceases;

•Later, as a result of fluctuating stimulation, a mixed pattern develops with areas of active lobules and areas of inactive lobules;

•Active lobules become more vascular and hyperplastic until haemorrhage occurs, causing central necrosis and leaving only a surrounding rim of active follicles;

•Necrotic lobules coalesce to form nodules filled with either iodine-free colloid or a mass of new but inactive follicles;

•Continual repetition of this process results in a nodular goiter. Most nodules are inactive and active follicles are present only in the inter nodular tissue.

Clinically discrete swellings

Discrete thyroid swellings (thyroid nodules) are common and are present in 3—4 per cent of the adult population

Some 15per cent of isolated swellings prove to be malignant, and an additional 30—40 per cent are follicular adenomas. The remainder are non-neoplastic largely consisting of areas of colloid degeneration, thyroiditis or cysts.

Neoplasms of the thyroid

Benign tumours

Follicular adenomas present as clinically solitary nodules and the distinction between a follicular carcinoma and an adenoma can only be made by histological examination: in the adenoma there is no invasion of the capsule or of pericapsular blood vessels.

Malignant tumours

The vast majority of primary growths is carcinomas. Dunhill classified them histologically as differentiated and undifferentiated: and the differentiated carcinomas are now subdivided into follicular and papillary. Secondary growths are rare but blood-borne metastases occur. Blood borne metastases more usually occur from primary carcinomas of breast, colon and kidney and from melanomas.

Etiology of malignant thyroid tumours

Differentiated thyroid carcinoma, particularly papillary, frequently follows accidental irradiation of the thyroid in childhood. The incidence of follicular carcinoma is high in endemic goitrous areas, possibly owing to TSH stimulation. Malignant lymphomas can present in a patient known to have autoimmune thyroiditis, so that the lymphocytic infiltration in the autoimmune process may be an etiological factor. Indeed, it is likely that all lymphomas of the thyroid arise in glands affected by such thyroiditis.

Clinical features of thyroid neoplasms

The annual incidence is about 3.7 per 100 000 of the population and the sex ratio is three females to one male. The mortality should only be of the order of 2—3 per cent. The commonest presenting symptom is a thyroid swelling and a 5-year history is far from uncommon in differentiated growths. Enlarged cervical lymph nodes may be the presentation of papillary carcinoma. Recurrent laryngeal nerve paralysis may be a presenting feature of locally advanced disease.

Papillary carcinoma

Most papillary tumours contain a mixture of papillary and colloid-filled follicles, and in some the follicular structure predominates. Nevertheless, if any papillary structure is present, the tumour will behave in a predictable fashion as a papillary carcinoma. Histologically the tumour shows papillary projections and characteristic pale, empty nuclei (Orphan Annie-eyed nuclei). Papillary carcinomas are very seldom encapsulated. Multiple foci may occur in the same lobe as the primary tumour or, less commonly, in both lobes. They may be due to lymphatic spread in the rich intrathyroidal lymph plexus, or to multicentric growth.

Follicular carcinoma

These appear to be macroscopically encapsulated but microscopically there is invasion of the capsule and of the vascular spaces in the capsular region. Multiple foci are seldom seen and lymph node involvement is much less common than in papillary carcinoma. Blood-borne metastases are almost twice as common

Undifferentiated (anaplastic) carcinoma

This occurs mainly in elderly women and is much less often diagnosed now than in the past when many thyroid lymphomas were mistakenly classified histologically as anaplastic carcinomas. Local infiltration is an early feature of these tumours with spread by lymphatics and by the bloodstream.

Medullary carcinoma

These are tumours of the parafollicular (C)-cells derived from the neural crest and there is a characteristic amyloid stroma . High levels of serum calcitonin (>0.08 ng/ml) are produced by many medullary tumours.

Thyroiditis

Chronic lymphocytic (autoimmune) thyroiditis

It commonly presents as a multinodular goiter. Features of chronic lymphocytic (focal) thyroiditis are commonly present on histological examination in association with other thyroid disease — notably toxic goiter. Primary myxoedema without detectable thyroid enlargement repre-sents the end stage of the pathological process.

Granulomatous thyroiditis (subacute thyroiditis —de Quervain's thyroiditis)-This is due to a virus infection. In a typical subacute presentation there is pain in the neck, fever, malaise and a firm, irregular enlargement of one or both thyroid lobes.

Riedel's thyroiditis-This is very rare, accounting for 0.5per cent of goiters. Thyroid tissue is replaced by cellular fibrous tissue which infiltrates through the capsule into adjacent muscles, para tracheal connective tissue and the carotid sheaths.

Diagnostic aids

Examination sequence

- Inspect the neck from the front.
- Look for a thyroid swelling while the patient swallows a sip of water. The thyroid (or a thyroglossal cyst) moves upwards on swallowing since it is enveloped in the pretracheal fascia, which is attached to the cricoid cartilage.
- Ask the patient to sit with the neck muscles relaxed and stand behind the patient.
- Place your hands gently on the front of the patient's neck with your index fingers just touching the goiter.
- Note the size, shape and consistency of any goiter, and the presence or absence of a thrill. Measure any discrete nodules with calipers.
- Listen with the diaphragm of your stethoscope for a thyroid bruit.
- Look for any lymph nodes.

Tests of Thyroid Function: A multitude of different tests are available to evaluate thyroid function. No single test is sufficient to assess thyroid function in all situations and the results must be interpreted in the context of the patient's clinical condition. TSH is the only test necessary in most patients with thyroid nodules that clinically appear to be euthyroid.

Serum TSH

The tests for serum TSH (normal 0.5 to 5 mIU/mL) are based on the principle that monoclonal TSH antibodies are bound to a solid matrix and bind serum TSH. A second monoclonal antibody binds to a separate epitope on TSH and is labeled with radioisotope, enzyme or fluorescent tag. Therefore, the amount of serum TSH is proportional to the amount of bound secondary antibody (immunometric assay). Older radioimmunoassays for TSH were able to detect elevated TSH levels in hypothyroidism, but were not sensitive enough to detect suppressed levels of TSH characteristic of hyperthyroidism. Newer, second-generation, "sensitive" TSH assays can measure levels less than 0.1mIU/mL and third-generation or "supersensitive or ultrasensitive" assays can detect TSH levels as low as 0.01mIU/mL. Serum TSH levels reflect the ability of the anterior pituitary to detect free T_4 levels. There is an inverse relationship between the free T_4 level and the logarithm of the TSH concentration—small changes in free T_4 lead to a large shift in TSH levels. Thus, the ultrasensitive TSH assay has become the most sensitive and specific test for the diagnosis of hyper- and hypothyroidism and for optimizing T_4 replacement and suppressive therapy.

Total T_4 and Total T_3

Total T_4 (reference range: 55 to 150 nmol/L) and T_3 (reference range:1.5 to 3.5 nmol/L) levels are measured by radio-immunoassay and measure both the free and bound components of the hormones. Total T_4 levels reflect the output from the thyroid gland, whereas T_3 levels in the non-stimulated thyroid gland are more indicative of peripheral thyroid hormone metabolism and are, therefore, not generally suitable as a general screening test. Total T_4 levels are increased not only in hyperthyroid patients, but also in those patients with elevated thyroglobulin levels secondary to pregnancy, estrogen/progesterone use, or congenital diseases. Similarly, total T_4 levels decrease in hypothyroidism and in patients with decreased thyroglobulin levels caused by anabolic steroid use and by protein-losing disorders such as nephrotic syndrome. Individuals with these latter disorders may be euthyroid if their free T_4 levels are normal. Measurement of total T_3 levels is important in clinically hyperthyroid patients with normal T_4 levels, who may have T_3 thyrotoxicosis. As discussed previously, total T_3 levels are often increased in early hypothyroidism.

Free T_4 and Free T_3

These radioimmunoassay-based tests are a sensitive and accurate measurement of biologically active thyroid hormone. Free T_4 (reference range: 12 to 28 pmol/L) estimates are not performed as a routine screening tool in thyroid disease. Use of this test is confined to cases of early hyperthyroidism in which total T_4 levels may be normal but free T_4 levels are raised. In patients with end-organ resistance to T_4 (Refetoff syndrome), T_4 levels are increased, but TSH levels usually are normal. Free T_3 (reference range: 3 to 9 pmol/L) is most useful in confirming the diagnosis of early hyperthyroidism, in which levels of free T_4 and free T_3 rise before total T_4 and T_3. Free T_4 levels may also be measured indirectly using the T_3 resin-uptake test. If free T_4 levels are increased, fewer hormone-binding sites are available for binding radiolabeled T_3 that has been added to the patient's serum. Therefore, more T_3 binds with an ion-exchange resin and the T_3 resin uptake is increased.

Evaluation of the Pituitary-Thyroid Feedback Loop

Evaluation of serum TSH is an important screening test for the diagnosis of thyroid status. TSH is measured by an ultrasensitive radioimmunometric assay, and this has greatly improved clinical diagnosis. This is especially important in the delineation of hypothyroid from euthyroid states. Additionally, clinically euthyroid patients may have suppressed TSH values, demonstrating hyperthyroidism before it becomes clinically manifest. The sensitivity of the TSH assay is also less affected by nonthyroid disease processes and remains unaffected by changes in the thyroid hormone-binding proteins.

More elaborate tests of the functional status of the hypothalamic-pituitary axis may require the use of a TRH stimulation test. An intravenous dose of TRH is given, for which a normal response should be an elevation in TSH that peaks within 15 to 35 minutes. Pituitary insufficiency then demonstrates a subnormal response to TRH, whereas patients with primary hypothyroidism demonstrate an enhanced TSH release from the anterior pituitary.

The use of the T_3 suppression tests evaluates the autonomous function of the gland because T_3 suppresses TSH release from the pituitary. An 8-10 day course of T_3 is administered, and a radioactive iodine uptake is then performed. The normal response should be a suppression of radioactive iodine uptake to less than 50% of initial values. An autonomously hyperfunctioning thyroid gland demonstrates a lack of suppression of the radioactive iodine uptake.

Thyroid Antibodies

Thyroid antibodies include antithyroglobulin (anti-Tg), antimicrosomal or antithyroid peroxidase (anti-TPO) and thyroid-stimulating immunoglobulin (TSI). Anti-Tg and anti-TPO antibody levels do not determine thyroid function; instead, they indicate the underlying disorder, usually an autoimmune thyroiditis. Approximately 80% of patients with Hashimoto's thyroiditis have elevated thyroid antibody levels, but levels may also be increased in patients with Graves' disease, multinodular goiter, and, occasionally, with thyroid neoplasms.

Serum Thyroglobulin

Thyroglobulin is not normally released into the circulation in large amounts, but increases dramatically in destructive processes of the thyroid gland, such as thyroiditis or overactive states such as Graves' disease and toxic multinodular goiter. The most important use for serum thyroglobulin levels is in monitoring patients with differentiated thyroid cancer for recurrence, particularly after total thyroidectomy and radioactive iodine ablation.

Erythrocyte sedimentation rate (ESR)

The ESR is often raised (over 90 mm/h) in many patients with myxoedema and Hashimoto's thyroiditis, and is markedly elevated in de Quervain's thyroiditis.

Calcitonin

The parafollicular cells, or C cells, of the thyroid elaborate a 32-amino acid polypeptide, calcitonin. The important physiologic consequence of calcitonin is to decrease peripheral levels of calcium. Malignancies that involve calcitonin excess include MCT, although the physiologic action of calcitonin does not appear to be manifest; hypocalcemia is not a problem in these patients. In patients with thyroid masses and in whom multiple endocrine neoplasia (MEN) Type 2 syndrome is suspected, a baseline calcitonin level can be drawn. If there is doubt about the diagnosis, a pentagastrin- or calcium-stimulated calcitonin evaluation can be performed employing a 4- to 5-hour test. Additionally, calcitonin can be used as a screening test in families with MEN Type 2 syndrome in documenting clinically inapparent disease. Use of calcitonin screening in patients with a thyroid mass, however, is most likely not cost-efficient.

Fine-needle aspiration or aspiration biopsy cytology

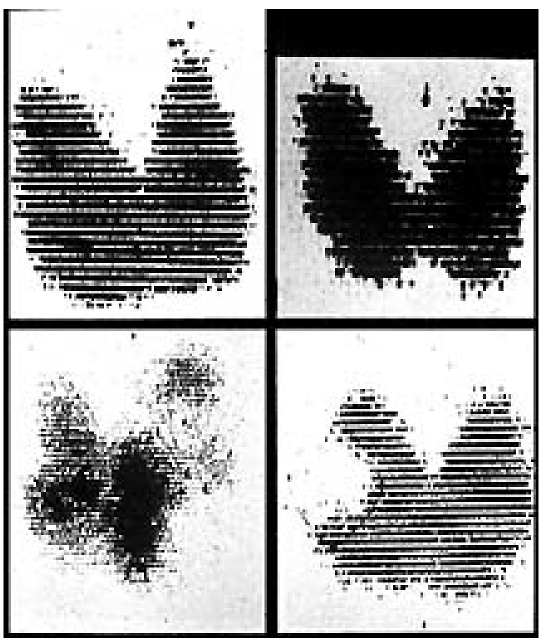
This technique, promoted by the Karolinska Institute in Sweden for over 40 years, has now gained acceptance as the procedure of choice in evaluating thyroid nodules, having replaced radionuclide and ultrasonographic scanning. A 25G disposable needle on a 10-ml syringe enables cells to be aspirated from any suspicious area of the thyroid.

Though fine-needle aspiration cytology is the preferred investigation of choice in patients with thyroid nodules it does have some limitations in the diagnosis of follicular or Hurthle-cell neoplasms. It is unable to demonstrate whether capsular or vascular invasion is present, the criteria needed to establish malignancy. Thus, when follicular cells are demonstrated on fine-needle aspiration from a thyroid nodule, 20 per cent will be malignant and 80 per cent benign; thyroid lobectomy to obtain definitive histological diagnosis is recommended in these patients. The needle technique is also less reliable in patients who have had irradiation to the head and neck or have a family history of thyroid cancer, as many of these patients have multifocal lesions.

Thyroid Imaging

Radionuclide Imaging

Both iodine-123 (^{123}I) and iodine-131 (^{131}I) are used to image the thyroid gland. The former emits low-dose radiation, has a half-life of 12 to 14 hours, and is used to image lingual thyroids or goiters. In contrast, ^{131}I use leads to higher-dose radiation exposure and has a half-life of 8 to 10 days. Therefore, this isotope is used to screen and treat patients with differentiated thyroid cancers for metastatic disease. The images provide information not only about the size and shape of the gland, but also the distribution of functional activity. Areas that trap less radioactivity than the surrounding gland are termed "cold", whereas areas that demonstrate increased activity are termed "hot." The risk of malignancy is higher in "cold" lesions (15 to 20%) than in "hot" or "warm" lesions (<5%). Technetium-99m (^{99m}Tc) pertechnetate is taken up by the thyroid gland and also used for thyroid evaluation. This isotope is taken up by the mitochondria, but is not organified. It also has the advantage of having a shorter half-life and minimizes radiation exposure. It is particularly sensitive for nodal metastases. More recently, 18 F-fluorodeoxyglucose positron emission tomography (FDG PET) has been used to screen for metastases in patients with thyroid cancer, in whom other imaging studies are negative. However, this technique is expensive and not widely available.



Ultrasound

Ultrasound is an excellent, noninvasive and portable imaging method for studying the thyroid gland, and it has the added advantage of no radiation exposure. It is helpful in the evaluation of thyroid nodules, distinguishing solid from cystic ones, and providing information about size and multicentricity. Ultrasound also can be used to assess for cervical lymphadenopathy and to guide fine-needle aspiration (FNA) biopsy. However, it cannot be used to image thyroid tissue outside the neck (e.g., to assess the extent of a substernal goiter).

CT/MRI Scan

These studies provide excellent imaging of the thyroid gland and adjacent nodes, and are particularly useful in evaluating the extent of large, fixed or substernal goiters and their relationship to the airway and vascular structures. Noncontrast CT scans should be obtained in patients who are likely to require subsequent radioactive iodine therapy.

Indications for surgery

Non-toxic goiter

Diffuse non-toxic goiter

- If there is no response by giving thyroxine, thyroidectomy may be indicated on cosmetic grounds.

Multinodular non-toxic goiter

- Cosmetic disfigurement, pressure symptoms, and discomfort.

Solitary nodular non-toxic goiter

Thyrotoxicosis

- Large toxic multinodular goiter/Plummer's disease
- Large diffuse toxic goiter (Graves' disease)
- Toxic solitary nodular goiter/toxic adenoma/autonomous ‘hot nodule'

Thyroid cyst

Carcinoma of the thyroid

Specific thyroid surgical procedures

Hemi thyroidectomy

Subtotal thyroidectomy

Total thyroidectomy

SURGICAL APPROACHES TO THE THYROID GLAND

Cervical Approach

A transverse incision is made about two fingerbreadths above the clavicular heads. The skin incision should be carried through subcutaneous fat and the platysmal muscle and superior and inferior flaps dissected medially beneath the platysmal layer. At this layer, anterior jugular veins are identified, and any of those crossing or running along the midline can be divided. The midline raphe should then be identified between sternohyoid muscles, and this raphe should be divided in a bloodless plane from the thyroid cartilage superiorly to the sternal notch inferiorly. As one enters the plane immediately beneath the sternohyoid muscles, one encounters the isthmus of the thyroid in the midline and each of the lobes laterally. Above and below the isthmus are the cartilaginous rings of the trachea. Blunt finger dissection can separate the sternohyoid muscle from the thyroid capsule medially and identify the sternothyroid muscles in a deep and lateral position. The sternothyroid muscles do not meet in the midline and must be separated off of the thyroid capsule to gain lateral exposure of the thyroid. Exposure of lateral structures is enhanced by placing medial traction on the thyroid lobes on either side. Care must be used to divide the middle thyroid vein before it is placed on excessive traction by this maneuver.

After the superior pole vessels are carefully dissected and identified, they can be double-ligated adjacent to their entrance into the thyroid lobe. After the superior thyroid vessels and middle thyroid veins have been divided, continued medial retraction of the thyroid lobe allows the posterior aspect of the thyroid lobe to be visualized. It is in this area that the superior parathyroids are usually found lying within small deposits of fat within the thyroid sheath.

Further mobilization of the thyroid lobe allows exposure of the tracheo-esophageal groove and the recurrent laryngeal nerve.

Minimal dissection of the lower vessels entering the thyroid should be undertaken, and no division should be done until the recurrent laryngeal nerve is seen and positively identified.

After the recurrent laryngeal nerve is seen, the inferior vessels may be divided while the course of the recurrent laryngeal nerve is directly visualized. Continued medial traction of the lobe then identifies the cephalad course of the nerve to where it disappears under the ligament of Berry or into its final destination, the caudal border of the cricothyroid muscle. The ligament of Berry is in a position just anterior and slightly medial to the nerve's entrance underneath the cricothyroid muscle, and this structure, with a small rim of thyroid tissue, can be ligated using 3-0 silk suture.

A total thyroidectomy involves division of all thyroid tissue between the entrances of the recurrent laryngeal nerves bilaterally by the ligament of Berry, resulting in complete removal of virtually all visible thyroid tissue bilaterally. A near-total thyroidectomy should involve complete dissection on one side while leaving a remnant of thyroid tissue laterally on the contralateral side, which should incorporate the parathyroids. A subtotal thyroidectomy leaves a rim of thyroid tissue bilaterally, ensuring parathyroid viability and avoiding entrance of the recurrent laryngeal nerves into the larynx.

MATERIALS AND METHODS

Design:

A single institution study done during the period from July 2007 to October 2009 in the Department of Surgery, K.A.P.V.Government Medical College; A.G.M.GH, Trichy. All the patients who underwent thyroid surgeries were selected for the study.

Setting:

Tertiary academic referral centre.

Patient:

Eighty seven patients who underwent thyroid surgeries for various thyroid disorders.

Selection of patients:

A patient with

- Colloid goiter
- Non toxic non malignant multinodular goiter
- Solitary nodule
- Carcinoma thyroid
- Thyrotoxic patient ,toxicity under control

RESULTS:

This is a study of eighty seven patients during the period from July 2007 to October 2009 in the Department of Surgery, K.A.P.V.Government Medical College; A.G.M.GH, TRICHY who underwent thyroid surgeries.

PATIENTS:

Of the eighty seven patients who underwent thyroid surgeries, eighty two were female and five were male, with a striking female preponderance.

AGE:

The average age of the patient is 36.65 years

The average age of female patient is 36.24 years

The average age of male patient is 43.2 years

The minimum age is 7 years

The maximum age is 70 years

Age presentation in our study is as follows:

AGE IN YEARS	FEMALE	MALE	TOTAL
<10	0	1	1
11-20	1	0	1
21-30	29	O	29
31-40	31	2	33
41-50	14	0	14
51-60	6	0	6
61-70	1	2	3
TOTAL	82	5	87

PRESENTATION:

The common symptom was swelling. Some had pain. Some had mild pressure effects. One secondary toxicosis patient had her symptom under control due to medications.

No patient presented with neck nodes or secondary metastasis.

The clinical presentations are as follows:

Type	Goiter	Solitary nodule	Carcinoma	MNG	Total
No	19	45	5	18	87

The final pathological diagnosis is:

Type	Goiter	Adenoma	Carcinoma	MNG	Thyroiditis	Total
No	29	43	5	3	7	87

The FNAC results are as follows:

FNAC	Goiter	Nodule	Cyst	Follicular neoplasm	Papillary CA	Thyroiditis	Hyper-plastic goitre	Atypical adenoma	Total
No	30	39	1	8	4	3	1	1	87
%	35	45	1	9	5	3	1	1	100

The biopsy results are as follows:

Biopsy	MNG	Adenoma	Goiter	thyroiditis	Follicular CA	Papillary CA	Medullary CA	Total
No	3	43	29	7	0	4	1	87
%	5	50	34	8	0	4	1	100

Cytodiagnosis

Cytodiagnoses can be divided into these categories : benign (negative), suspicious (indeterminate), malignant (positive)

Patients with a "benign" cytodiagnosis do not have malignancy and may have a normal thyroid, a colloid nodule, lymphocytic thyroiditis, subacute thyroiditis, or other benign conditions.

Patients with a suspicious (indeterminate) cytodiagnosis have specimens showing hypercellularity and a pattern suggestive of follicular- or Hurthle-cell neoplasms or atypical features suggestive of, but not diagnostic for, malignancy

Patients with a malignant cytodiagnosis have cytologic findings indicating the presence of malignant cells consistent with primary or metastatic thyroid carcinoma.

As per the above criteria, our study shows:

TYPE	NO	PERCENTAGE
BENIGN	74	85
MALIGNANT	4	5
SUSPICIOUS	9	10
TOTAL	87	100

The 9 patients in suspicious category include 7 follicular neoplasm; 1

atypical adenoma; 1 hyperplastic goiter.

Yield of cancer:

Defined as the ratio of the total number of patients with carcinoma to the total number of cases operated.

False negative diagnosis:

Defined as percentage of patients with benign cytologic findings who are confirmed to have malignant lesions of thyroid.

False positive diagnosis:

Defined as percentage of patients with malignant fine needle aspirates who are found to have benign lesions at surgery.

$$\textbf{Sensitivity} = \frac{\textbf{true positive}}{\textbf{Truepos+falseneg}}$$

$$\textbf{Specificity} = \frac{\textbf{true negative}}{\textbf{Trueneg+falsepos}}$$

Sensitivity & specificity results depend on the suspicious category. If suspicious lesions are positive, then sensitivity increases & specificity decreases and vice versa.

Our study shows:

- One patient with papillary CA on FNAC had follicular lesion as her biopsy report- one false positive
- One patient with atypical adenoma had papillary CA as her biopsy

report- one false negative

Our study values are:

DIAGNOSIS	TRUE POSITIVE	FALSE POSITIVE	FALSE NEGATIVE	TRUE NEGATIVE
NO	4	1	1	81

Applying these values , the results are:

Sensitivity : 80%

Specificity : 98.78%

False negative%: 20%

False positive%: 1.2%

YIELD:5.7%

The types of surgeries are as follows:

Hemi thyroidectomy

Subtotal thyroidectomy

Total thyroidectomy

Maximum number of patients underwent hemithyroidectomy.

The values of these procedures are as follows:

Type	N0
Hemi thyroidectomy	56
Subtotal thyroidectomy	26
Total thyroidectomy	5
Total	87

PERCENTAGE OF MALIGNANCY IN SUSPICIOUS LESIONS:

Type	Number	Percentage
Benign	8	89
Malignant	1	11
Total	9	100

Discussion :

Management guidelines for patients with thyroid nodules and differentiated thyroid cancer recommend FNAC as the procedure of choice in the evaluation of thyroid nodules.

SYLVIA L.ASA reported that the follicular lesion which belongs to the suspicious category needs clinico pathological correlation for management.

JOHN BOEY et al reported a sensitivity rate of 92%.

M. Regina Castro, MD, and Hossein Gharib, MD "Continuing Controversies in the Management of Thyroid Nodules" *Ann Intern Med.* 2005;142:926-931 reported that Management of patients with nodules "suspicious for follicular neoplasm" is difficult, since only 15% to 20% of such lesions have been shown to be malignant.
Our study result is 11%.

YS Cheung,et al has high specificity and positive predictive values for thyroid cancer. He gives comparison of certain series:

series	No	malig-nant%	Susp-icious	FP %	FN %	Sens-itivity%	Spec-ificity%	PPV %	NPV %
Gharib etal1993	3144	32	10	3	5	83	92	83	92
Cheung etal1997	662	25	22	8	10	65	98	92	95
Ogawa etal2001	226	67	16	1	13	76	73	85	60
Sclabas etal2003	240	43	42	4	4	71	98	96	82
Morgan etal2003	253	93	29	26	46	55	74	70	67
Our study	87	5	9	1	20	80	99	80	99

On comparing the clinical presentation with final diagnosis, there are major differences. Although the carcinoma cases have high specificity, the benign lesions show high variability.

19 cases presented with MNG have their final diagnosis as follows: 7 adenoma; 6 colloid goiter; 3 thyroiditis; and only 2 MNG

Other variations noted are 3 goiter cases have their final diagnosis as adenoma. 6 adenoma cases have their final diagnosis as goiter.

3 thyroiditis case have their final diagnosis as goiter.

CONCLUSION:

The clinical presentation of benign thyroid swellings have varied benign pathological diagnosis.

The commonest presentation is solitary nodule and the commonest pathological finding is adenoma.

Of the malignant pathological findings, no follicular carcinoma is detected and the predominant carcinoma is papillary carcinoma.

FNAC in our study has high specificity. Hence malignant lesions are diagnosed fairly accurately.

However, its sensitivity is relatively low. Interpretation of negative result has to be made with caution to reduce the false negative rate.

Hence Fine-needle aspiration biopsy is safe, accurate, and cost-effective. The procedure has a central role in the management of thyroid nodules and should be used as the initial diagnostic test.

BIBLIOGRAPHY

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1. Bailey and Love’s practice of Surgery

2. Sabiston’s text book of Surgery

3. Schwartz principles of Surgery

4. Nyhus and Baker Mastery of Surgery

5. Harrison’s Internal Medicine

6. Gray’s Anatomy

7. Ganong’s Medical Physiology

8. Robin’s Pathological Basis of Disease

9. American Association of Clinical Endocrinologists medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. Endocr Pract. 2006;12(No. 1)

10. Management guidelines for patients with thyroid nodules and differentiated thyroid cancer. Thyroid 2006 Feb;16(2):109-42.

11. FINN NOE BENNEDBÆK AND LASZLO HEGEDU¨ S” MANAGEMENT OF THE SOLITARY THYROID NODULE” JCE & M² 2000 vol 85 no7

12. M. Regina Castro, MD, and Hossein Gharib, MD “Continuing Controversies in the Management of Thyroid Nodules” *Ann Intern Med.* 2005;142:926-931.

13. KEH-CHUAN LOH, FRANCIS S. GREENSPAN, FANG DONG, THEODORE R. MILLER, AND PETER P. B. YEO” Influence of Lymphocytic Thyroiditis on the PrognosticOutcome of Patients with Papillary Thyroid Carcinoma” Journal of Clinical Endocrinology and Metabolism 1999 Vol. 84, No. 2

14. W E G Thomas Thyroid swelling-a protocol for management J R Soc Med 1998;91(Suppl. 33):21-27

15. YS Cheung,et al Fine-needle aspiration cytology of thyroid nodules—how well are we doing? *Hong Kong Med J 2007;13:12-5*

16. Hossein Gharib, MD, and John R. Goellner, MD Fine-Needle Aspiration Biopsy of the Thyroid: An Appraisal *Annals of Internal Medicine.* 1993;118:282-289

17. Sylvia L.Asa The History And Histology Of Follicular Lesions Of Thyroid, Department of pathology, University of Toronto

18. *John Boey* Investigations for Thyroid-A Critical assessment Journal of the Hong kongMedical Association Vol. 39, No. 1. 1987

19. JEYARAM et al :fine needle aspiration in Hashimoto's thyroiditis Journal of Cytology 2007 24(3) :119-24

20. Irena Tabain et al : USG guided FNAC in thyroid nodule Acta clin croat 2004; 43:21-6

21. Peng Y, Wang HH. A meta-analysis of comparing fine-needle aspiration and frozen section for evaluating thyroid nodules. Diagn Cytopathol 2008;36:916-20.

22. Gomez et al: Inadequate fine needle aspiration biopsy samples: Pathologists versus other specialists **CytoJournal** 2009, **6**:9

MASTER CHART

A CLINICO PATHOLOGICAL STUDY OF THYROID SWELLINGS

K.A.P.VGOVT MEDICAL COLLEGE

AGMGH; TIRUCHIRAPALLI.

PATIENT DETAILS:

NAME: AGE: SEX:

ADRESS: I.P NO:

CLINICAL DETAILS;

HISTROY:

O/E:

DIAGNOSIS

PATHOLOGICAL DETAILS:

FNAC:

BIOPSY:

OTHER INVESTIGATIONS:

URINE:

BLOOD:

THYROID FUNCTION TEST:

RADIOLOGICAL:

IDL:

OTHERS:

SURGERY:

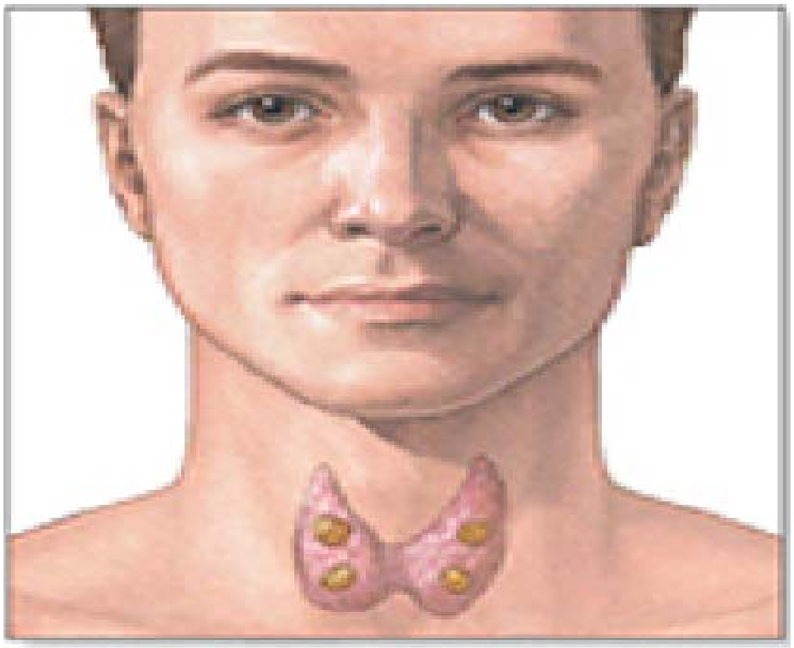
FINDINGS:

COMPLICATIONS:

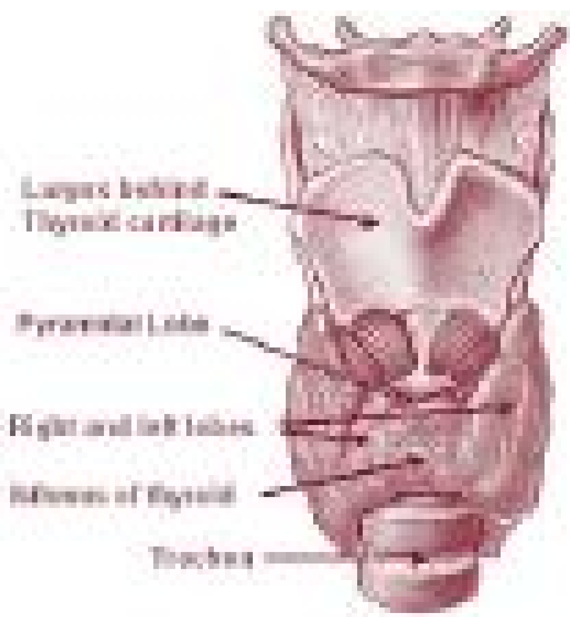
FOLLOW UP:

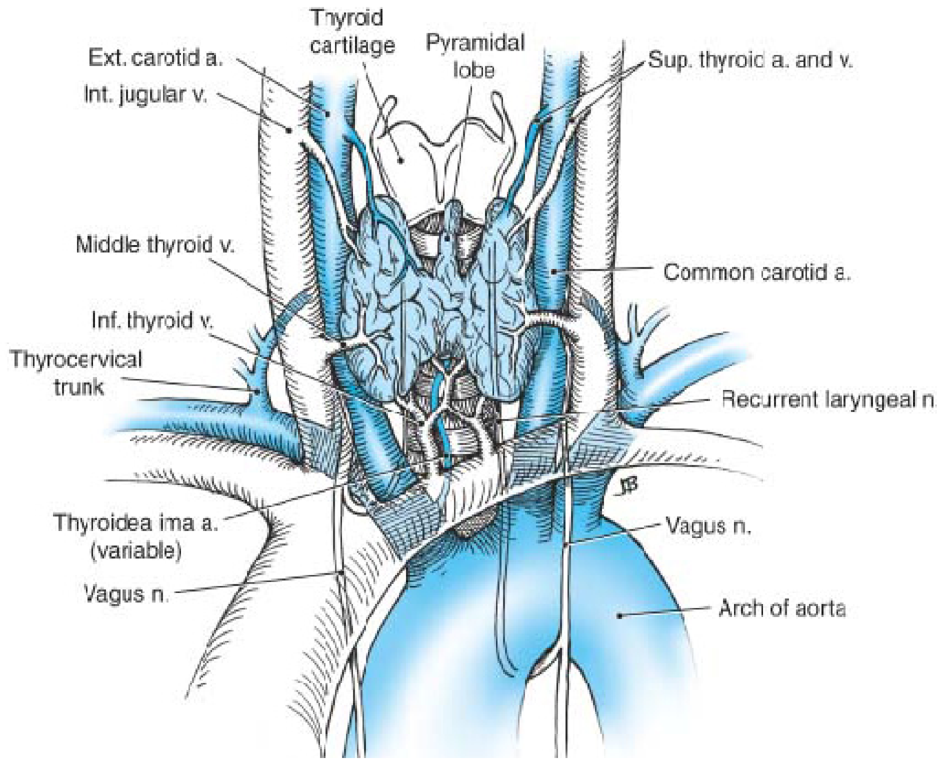
FINAL DIAGNOSIS:

Thyroid and parathyroid glands

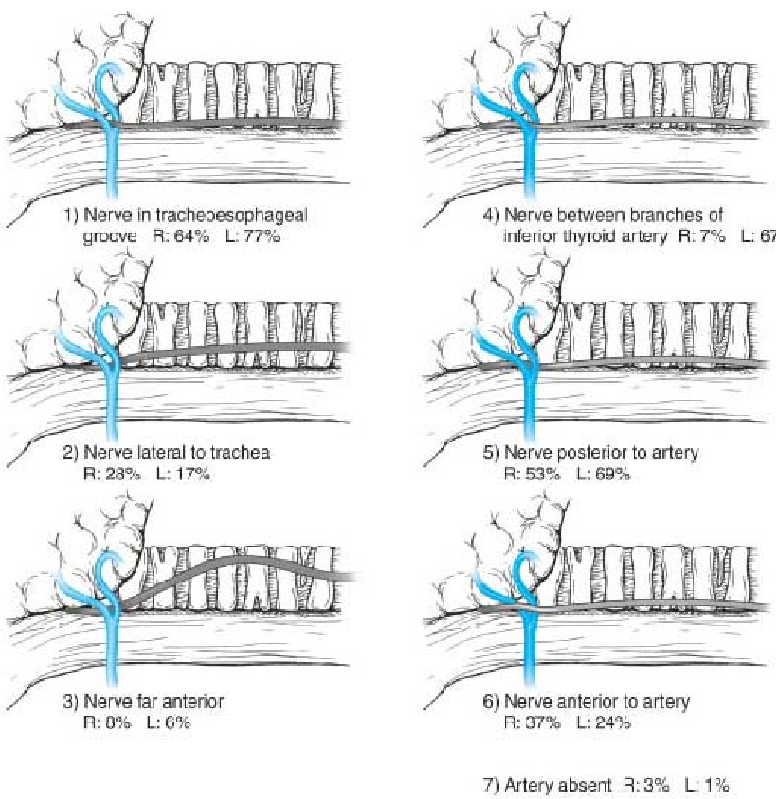


Relation of thyroid gland to the cartilages

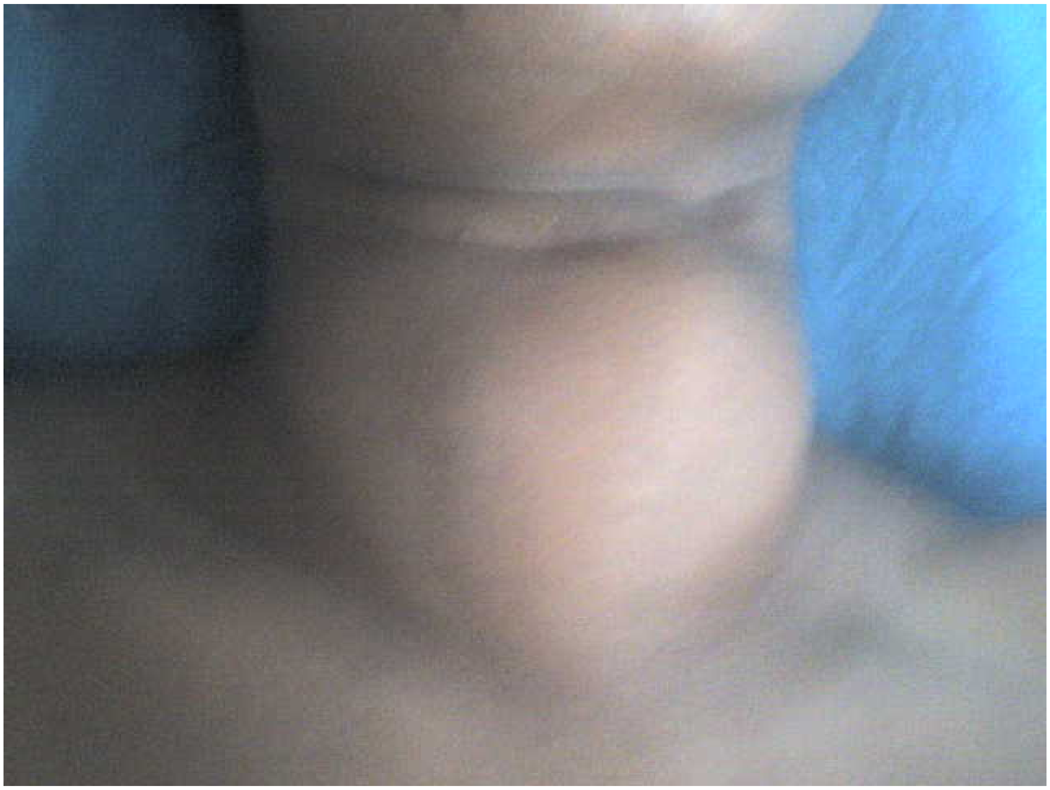




Vascular anatomy of thyroid

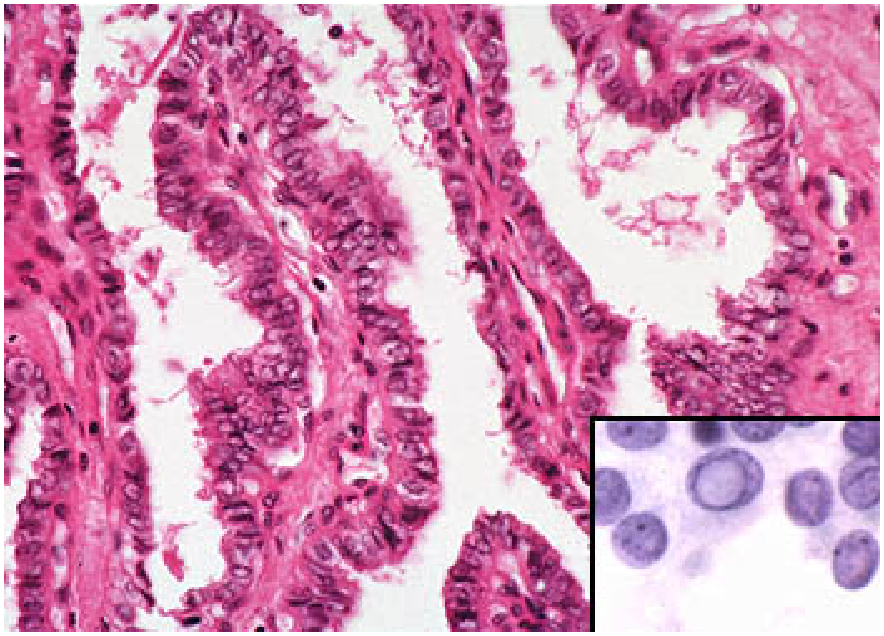


Recurrent laryngeal nerve variations

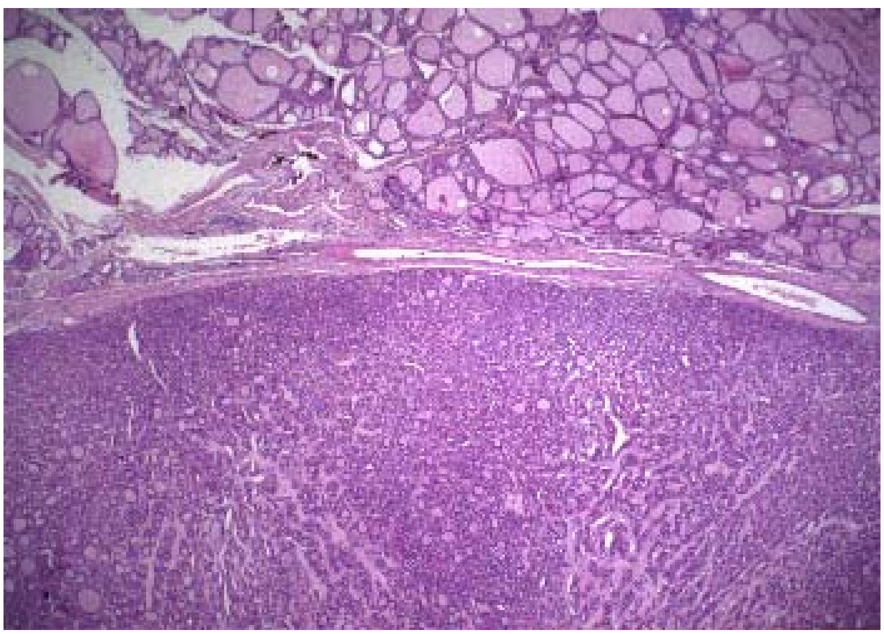


Colloid goiter

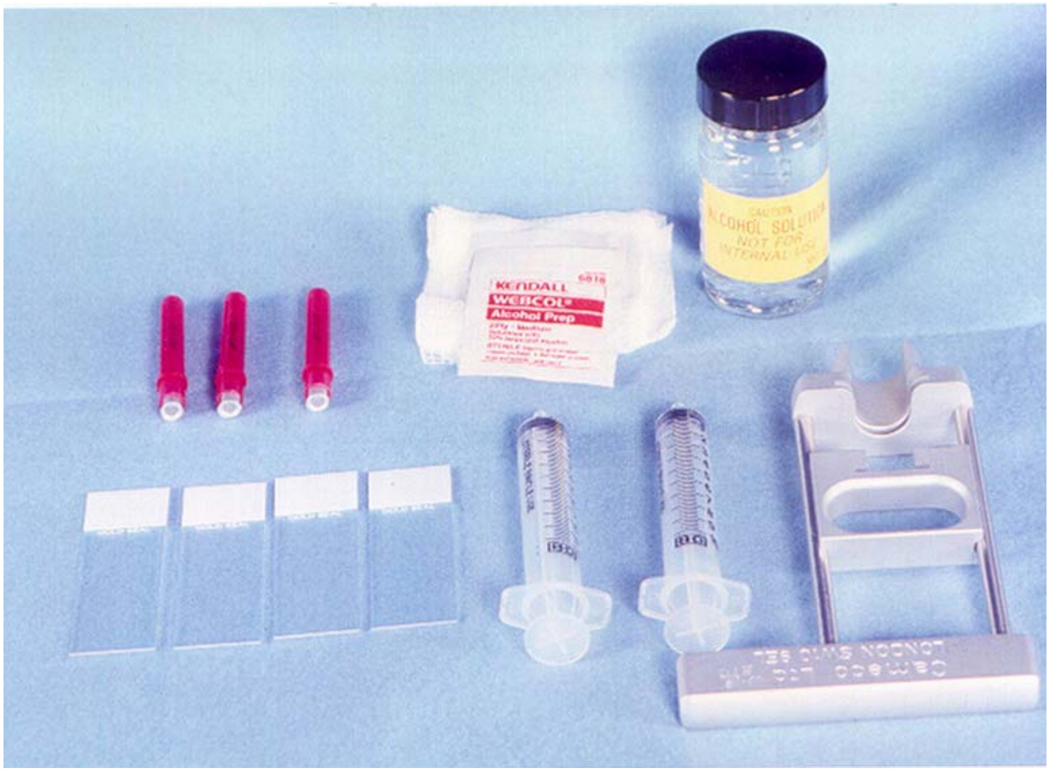
Solitary nodule



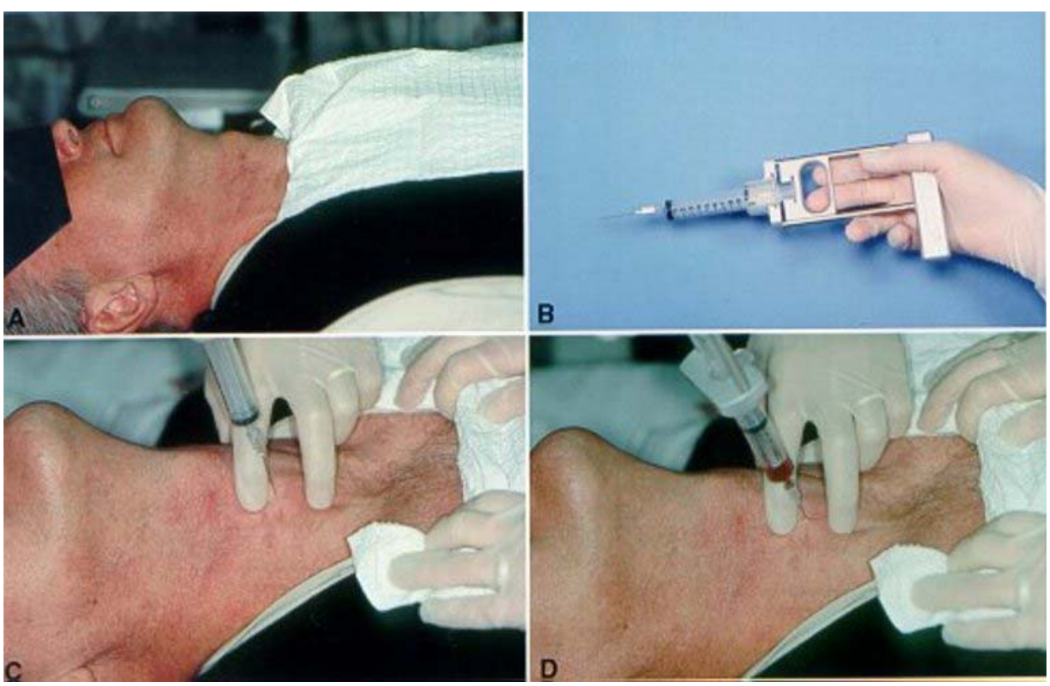
PAPILLARY CARCINOMA



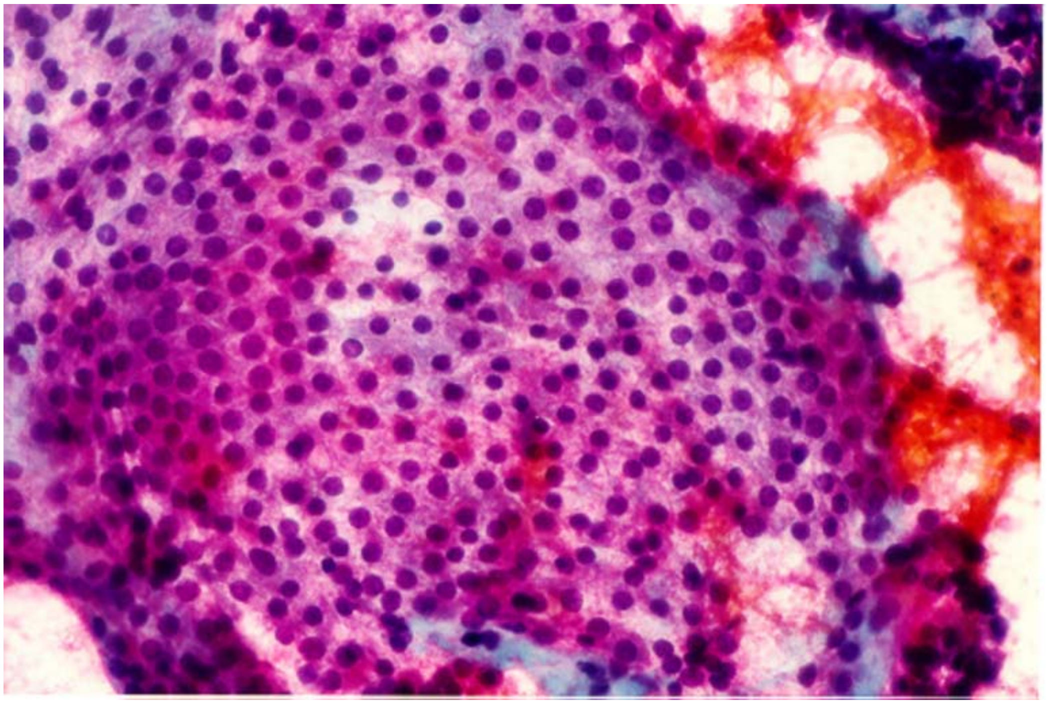
ADENOMA THYROID



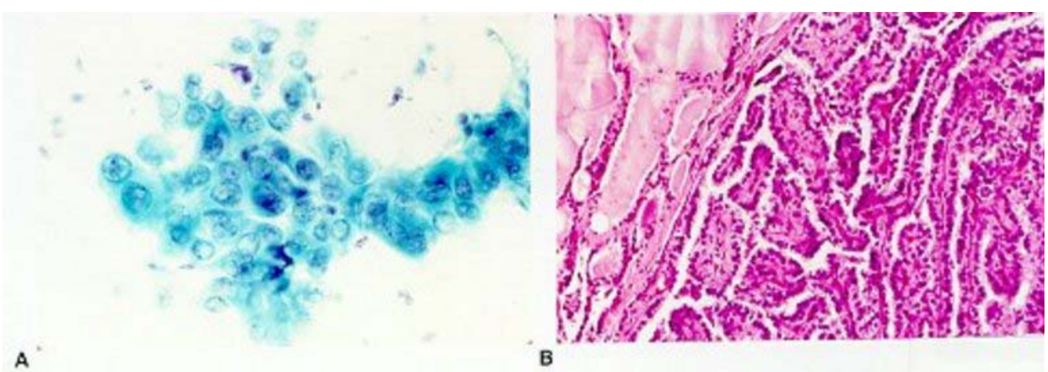
FNAC INSTRUMENTS



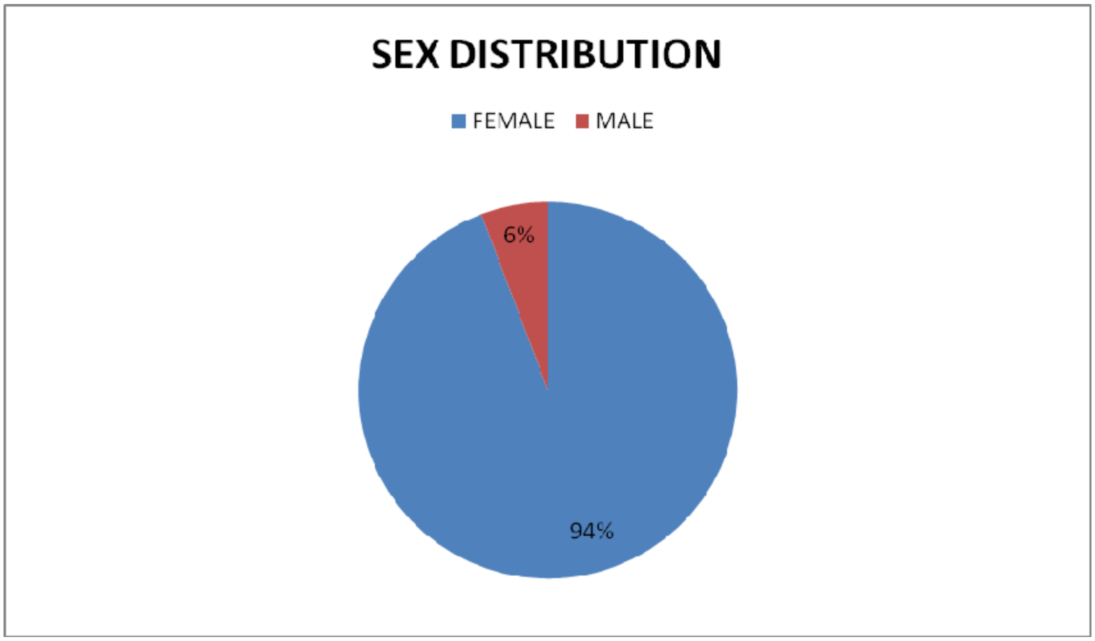
FNAC PROCEDURE

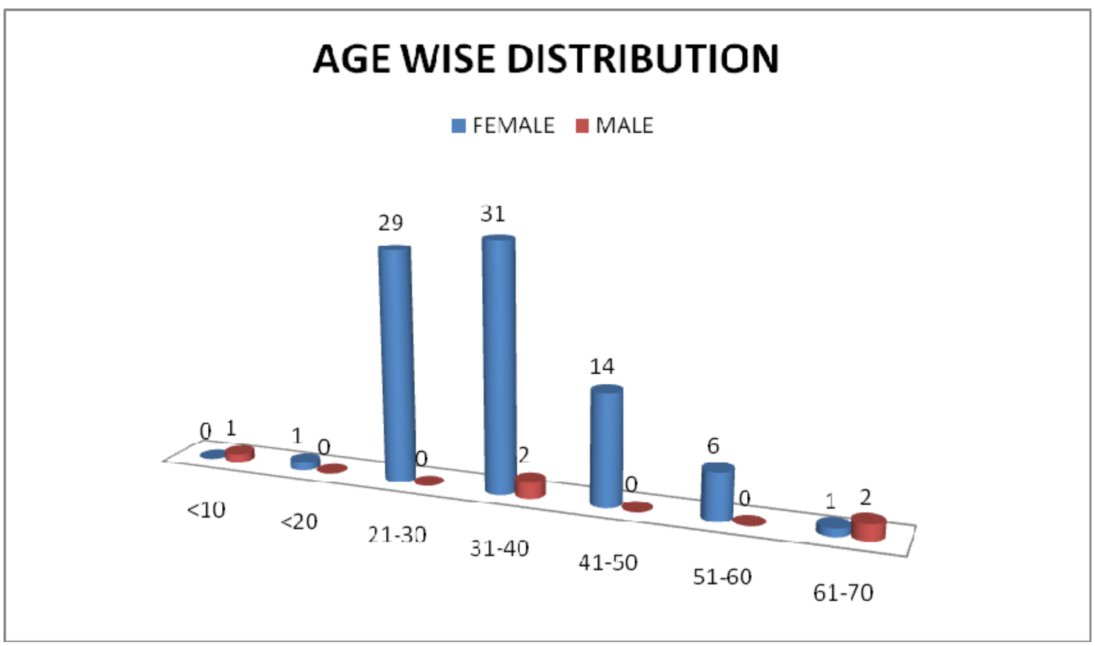


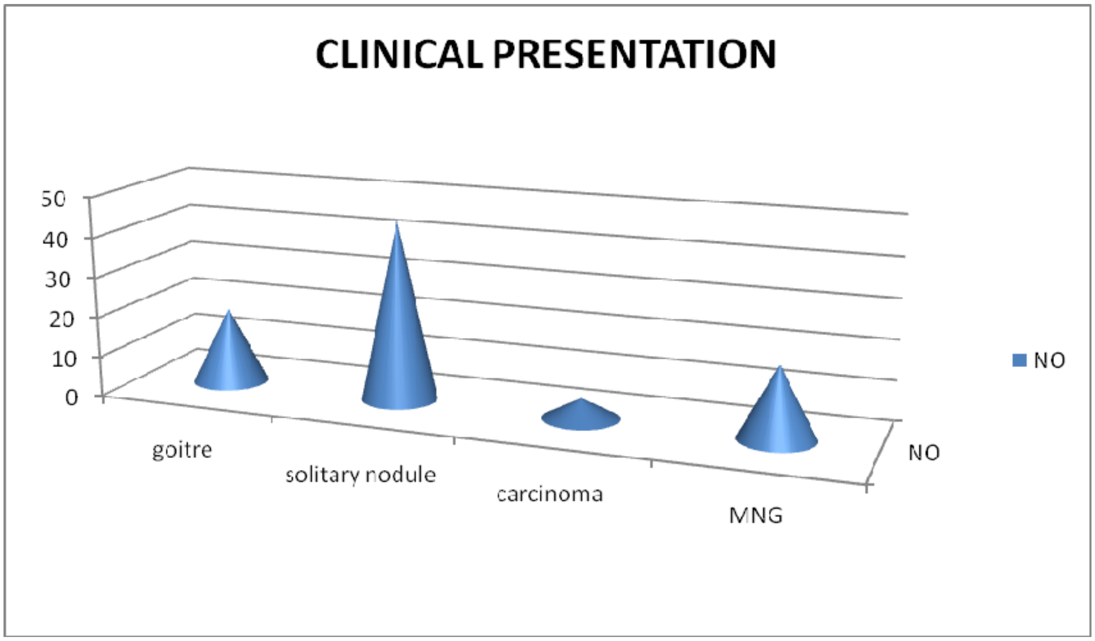
FNAC –COLLOID NODULE



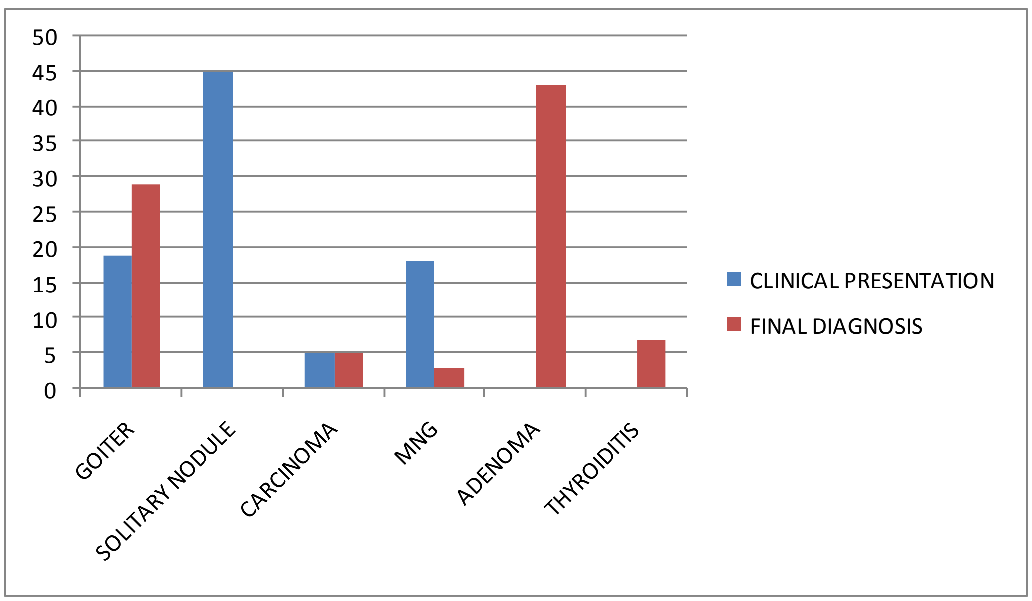
FNAC –PAPILLARY CA


SEX DISTRIBUTION
FEMALE
MALE
6%
94%

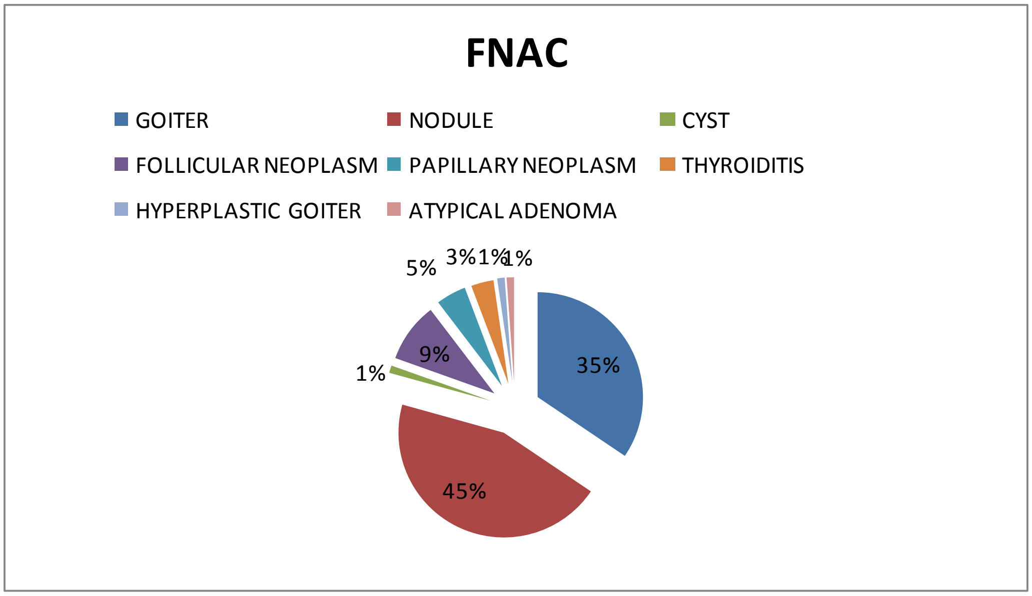

AGE WISE DISTRIBUTION
FEMALE
MALE
0
1
1
0
29
0
31
2
14
0
6
0
1
2
<10
<20
21-30
31-40
41-50
51-60
61-70

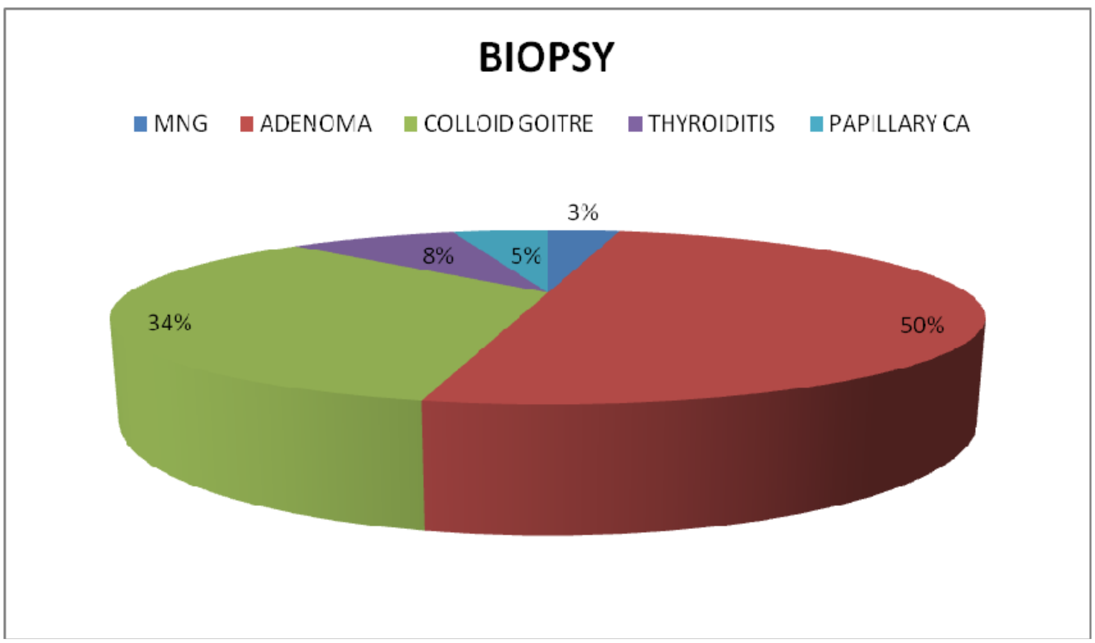


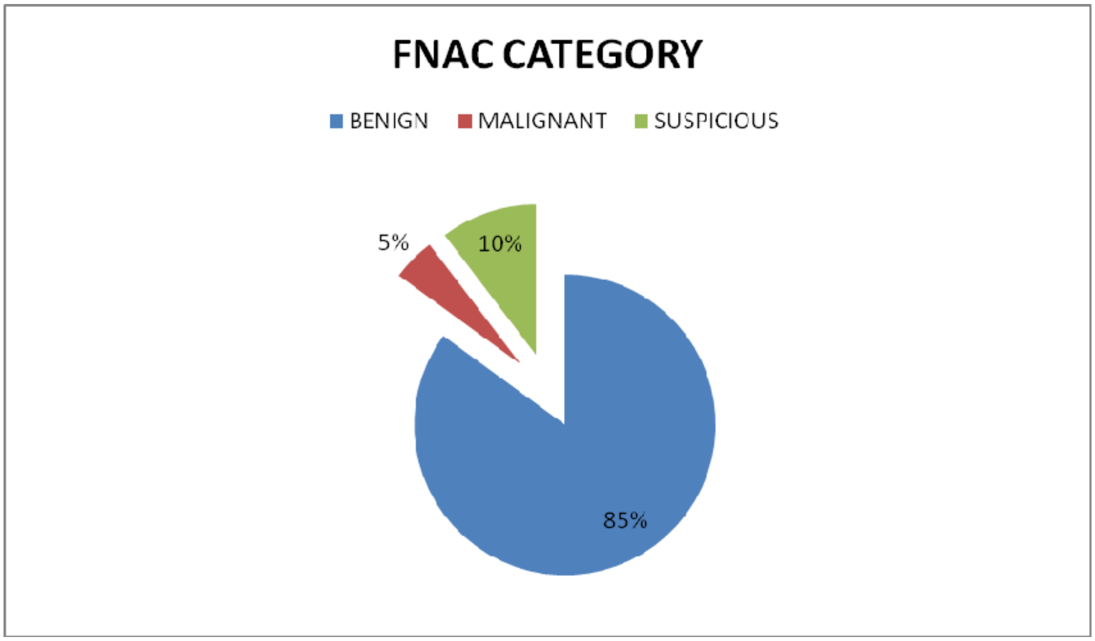
CLINICAL PRESENTATION
50
40
30
20
10
0
goitre
solitary nodule
carcinoma
MNG
NO
NO

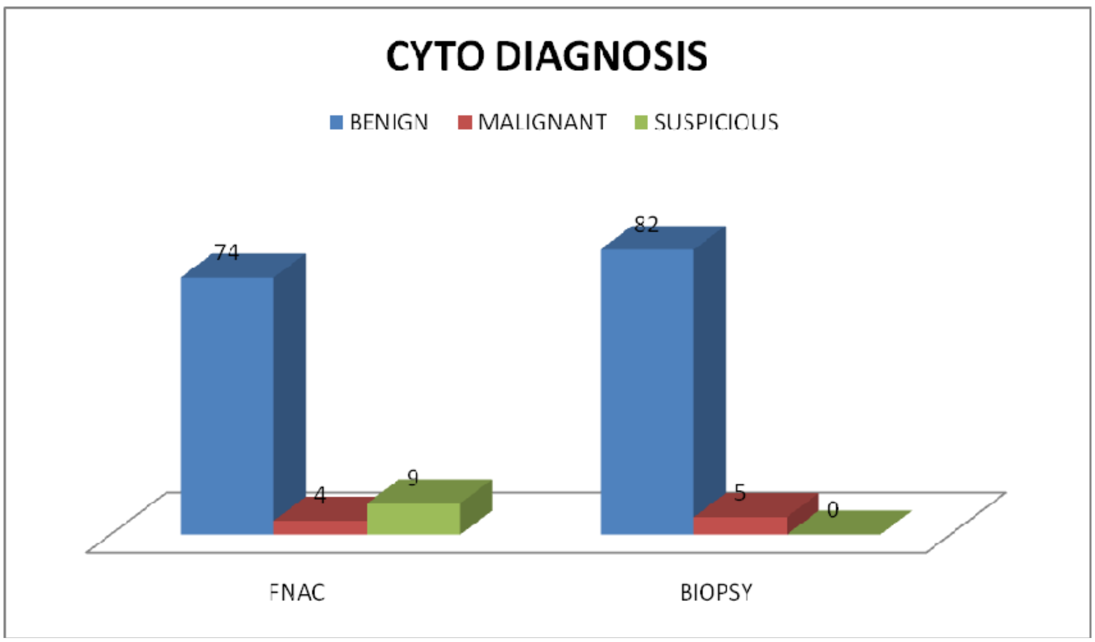


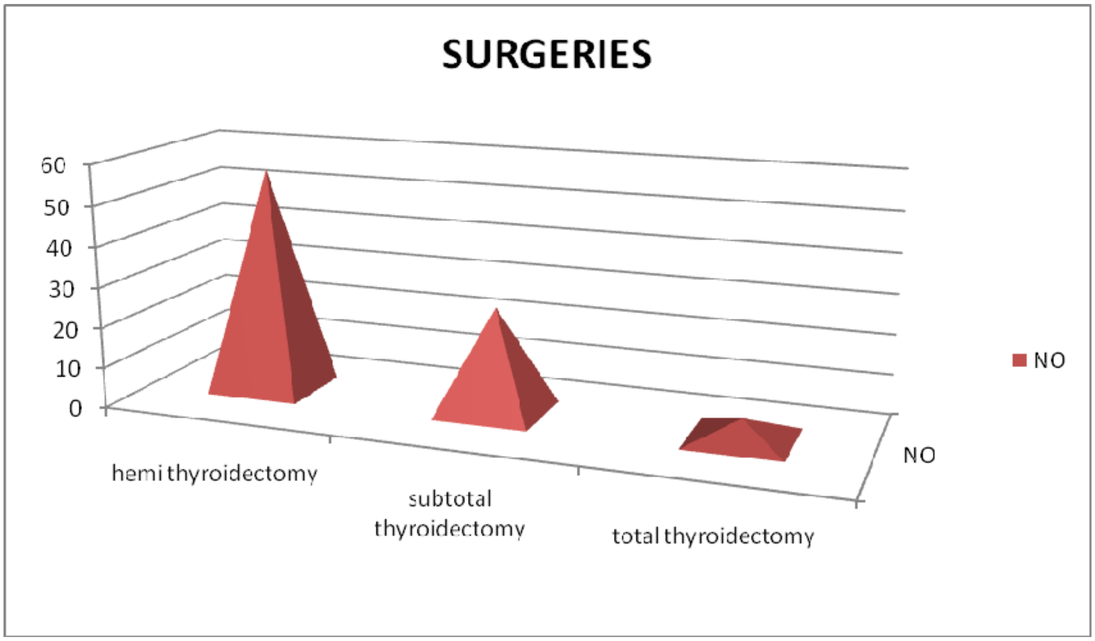
50
45
40
35
30
25
20
15
10
5
0
GOITER
SOLITARY NODULE
CARCINOMA
MNG
ADENOMA
THYROIDITIS
CLINICAL PRESENTATION
FINAL DIAGNOSIS

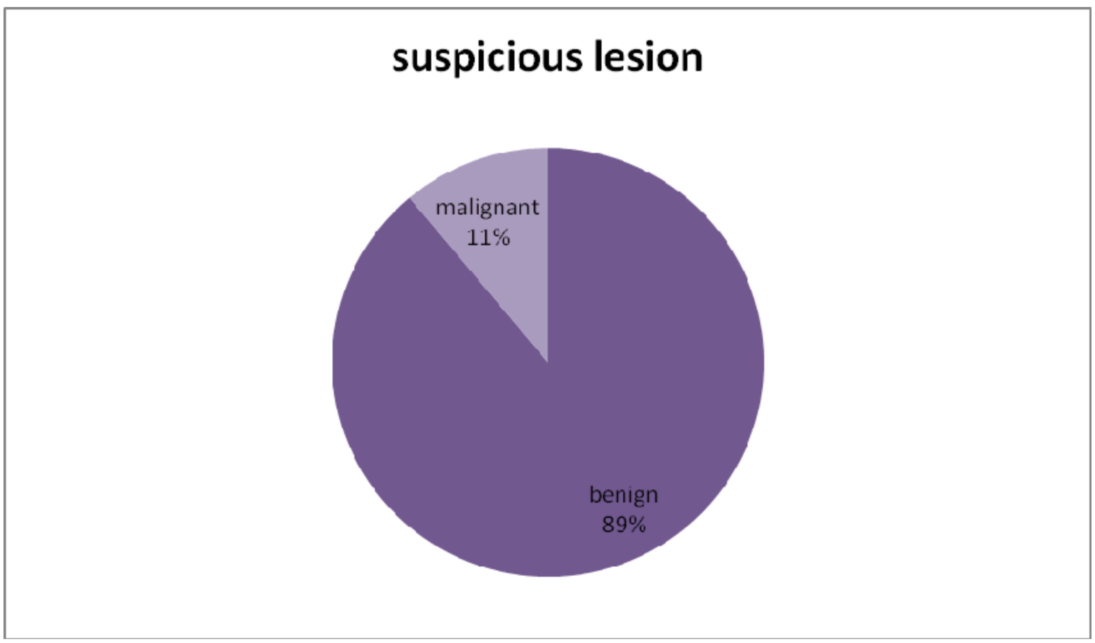

FNAC
GOITER
NODULE
CYST
FOLLICULAR NEOPLASM
PAPILLARY NEOPLASM
THYROIDITIS
HYPERPLASTIC GOITER
ATYPICAL ADENOMA
5%
3%
1%
1%
9%
1%
35%
45%


BIOPSY
MNG
ADENOMA
COLLOID GOITRE
THYROIDITIS
PAPILLARY CA
3%
8%
5%
34%
50%


FNAC CATEGORY
BENIGN
MALIGNANT
SUSPICIOUS
5%
10%
85%


CYTO DIAGNOSIS
BENIGN
MALIGNANT
SUSPICIOUS
74
4
9
82
5
0
FNAC
BIOPSY


SURGERIES
60
50
40
30
20
10
0
hemi thyroidectomy
subtotal thyroidectomy
total thyroidectomy
NO
NO


suspicious lesion
malignant
11%
benign
89%